

FUEL INJECTOR REMOVAL TOOL

RELATED APPLICATIONS

The present application claims priority to U.S. Provisional Patent
5 Application Serial No. 60/433,172, filed December 13, 2002, the contents of
which are expressly incorporated herein by reference.

BACKGROUND OF THE INVENTION

A. Field of the Invention

10 The invention relates to the field of laundry hampers. More specifically,
the invention relates to rigid-walled laundry hampers that can be collapsed for
convenient storage, shipment and merchandising.

B. Description of Related Art

Locomotive and other machinery with large diesel engines have fuel
15 injectors that inject fuel into a highly pressurized combustion chamber just before
a controlled explosion of that fuel. The injector is typically located in a cylinder
head of the motor and a tight sealing relationship must be attained between the
injector and the cylinder head to prevent the pressurized gases in the combustion
chamber from leaking past the fuel injector. Therefore, the fit between a bore in
20 the cylinder head for the fuel injector and the fuel injector is typically quite close.
An O-ring normally assists in providing the seal.

After they have been service for an extended period of time, the fuel
injectors require replacement. However, with use, the fuel injectors require
considerable force to be removed from the cylinder head because the o-ring

becomes hard with time and carbon deposits build up upon the fuel injector and cylinder head and serve to bond the cylinder head and fuel injector together.

In the past, different tools have been used to remove the fuel injectors from the cylinder head with varying results. Before the present invention, the best method of removing the fuel injectors was to thread a slide hammer onto the end
5 of the fuel injector to remove the fuel injector. A slide hammer is essentially a large weight, in a form that can be gripped by a user, with a bore in the center. A long rod is inserted through the bore in the weight and the rod further comprises a rod head that will not extend through the bore of the weight. The user attaches
10 the end of the rod to the fuel injector and repeatedly slams the weight against the rod head to remove the fuel injector.

As can be understood, a slide hammer requires a great amount of force to be exerted by the operator. Accidents with slide hammers are common, such as pinched and broken fingers and injuries from operators losing their balance while
15 operating the slide hammer. Additionally, considerable time may be required to extract stubborn fuel injectors from cylinder heads and, in some instances, the slide hammer simply cannot exert enough force to remove the fuel injector and the entire cylinder head must be removed and replaced, which is a time-consuming and expensive operation.

20 SUMMARY OF THE INVENTION

The present invention provides a fuel injector remover for removing a fuel injector from a cylinder head wherein the fuel injector is located within a
25 counterbore of the cylinder head. The remover comprises a primer mover having

a piston capable of translational motion from a first position to a second position. The piston defines a central bore. A snout portion is attached to the prime mover and defines a central bore generally coaxial with the central bore of the piston. The snout portion has a first end and a second end, wherein the first end is
5 attached to the prime mover. The second end defines a tapered portion sized such that when the tapered portion abuts an outer diameter of the cylinder head counterbore, the prime mover is centered over the fuel injector. A puller rod is also provided and has a first end adapted to be removably engaged with the fuel injector and a second threaded end. The puller rod extends through the central
10 bores of the piston and the snout. A thumbscrew is provided for attachment to the threaded end of the puller rod after the puller rod has been inserted through the central bore of the cylinder. When the puller rod has been attached to the fuel injector, the puller rod has been inserted through the central bore of the piston, and the thumbscrew has been attached to the puller rod, the prime mover may be
15 operated to force the piston from the first position to the second position to separate the fuel injector from the cylinder head.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

- Fig. 1 is a plan view of the injector puller of the present invention;
- 20 Fig. 2 is an exploded view of the hydraulic cylinder, interface flange and snout portion of the present invention;
- Fig. 3 is a view of the hydraulic cylinder, interface flange and snout portion of Fig. 2 rotated ninety degrees;

Fig. 4 is a plan view of the puller rod and thumbscrew of the present invention;

Fig. 5 is a partial section view of the injector puller of the present invention in use removing an injector installed in an engine cylinder head; and

5 Fig. 6 is a view of the injector puller of the present invention in use removing an injector installed in an engine cylinder head.

DESCRIPTION OF THE PREFERRED EMBODIMENT

While this invention is susceptible of embodiment in many different
10 forms, there is shown in the drawings and will herein be described in detail preferred embodiments of the invention with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the broad aspect of the invention to the embodiments illustrated.

15 The present invention improves the process of removal of fuel injectors by reducing the time, effort and injury involved with removing fuel injectors from a cylinder head. Referring to Figs. 1A and 1B, there is provided a fuel injector remover 10 as in the present invention. The fuel injector remover 10 generally comprises a prime mover comprising a hydraulic cylinder 12, a snout portion 14,
20 an interface flange 15 and a puller rod 16. The hydraulic cylinder 12 (Figs. 1-3) comprises a common hydraulic cylinder that is operated by either an electric or manual hydraulic pump (not shown). The hydraulic cylinder 12 has central bore 11 and a moveable piston 13. The construction and operation of a hydraulic

cylinder is well known in the art and the internal details of the hydraulic cylinder 12 are not shown here.

Referring to Figs. 2 and 3, the snout portion 14 is generally cylindrical and comprises a central bore 17 and two flats 18 on a first end 20 and two flats 22 on a second end 24. The first end 20 comprises a tapered portion 26 and a reduced portion 28, the function of which is explained below. Finally, the snout portion 14 comprises a flange 30 at the second end 24.

The interface flange 15 generally comprises a cylindrical portion 32 and a flange 34. The interface flange 15 has a tapered portion 36 and a central bore 38. When assembled in the present invention, the interface flange 15 is maintained in position between the hydraulic cylinder 12 and the snout portion 14 and the cylindrical portion 32 of the interface flange 15 is received by the central bore 17 of the snout portion 14.

Finally, referring to Fig. 4, the puller rod 16 comprises a rod 40 having an external threaded portion 42 at one end 44 and an internal threaded portion 46 at an opposite end 48. The end 48 further comprises a hex-shaped outer surface 50 such that a wrench may be used to turn puller rod 16. The hex-shaped outer surface 50 also comprises a tapered portion 52 that generally corresponds to tapered portion 36 of the interface flange 15. The puller rod 16 also comprises a thumbscrew 54 having a large diameter 56 with a knurled outer surface, a small diameter 58 and a threaded bore 60.

Referring to Figs. 5 and 6, the present invention is operated by first threading the internal threads 46 of the puller rod 16 onto external threads 70 of a

fuel injector 72 within a cylinder head 74, perhaps with the assistance of a wrench. The user should be certain to ensure that the puller rod 16 is sufficiently threaded onto the fuel injector 70. Next, the hydraulic cylinder 12, with the snout portion 14 and interface flange 15, attached are placed over the puller rod 16 such
5 that the puller rod 16 extends completely through the central bore 17 and the tapered portion 26 of the snout portion 14 contacts an outer diameter of a bore 78 in which the fuel injector 70 is located. The reduced portion 28 extends within the bore 78. The tapered portion 26 in this manner provides a self-centering function of the hydraulic cylinder 12 over the fuel injector 70. The flats 18 of the
10 snout portion 14 provide clearance for studs 76 that extend from the cylinder head 74 (Fig. 5). The thumbscrew 54 is then threaded onto the external threads 42 of the puller rod 16 until the thumbscrew abuts the piston 13.

At this point, the user operates either a hand pump or an electric pump to pump hydraulic fluid into the hydraulic cylinder 12 to operate the piston 13 in the
15 direction of the arrow A. The movement of the piston 13 moves the puller rod in the direction of the arrow A, thereby removing the fuel injector 70 from the cylinder head 74. If after the moving the piston 13 to the end of its travel, the fuel injector 70 is not completely removed, the piston 13 can be moved back to its initial position and the thumbscrew 54 further threaded onto the puller rod 16 to
20 fully remove the fuel injector 70.

In an alternative embodiment of the fuel injector remover, the end 44 of the puller rod 40 may have external threads engageable with internal threads in the end of a fuel injector, with the shank of the rod being formed to have flats

thereon to facilitate turning the rod with a wrench to make-up the connection. In addition, while the cylinder 12 has been described as being a hydraulic cylinder, it may also be a pneumatic cylinder, and a manual or power driven pneumatic pump may be provided to activate the cylinder.

- 5 In view of the above, it will be seen that several advantages of the present invention have been achieved and other advantageous results have been obtained.